Justin L. Rubinstein

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EDUCATION

Ph.D. Geophysics — **Stanford University** — **March 2006**
Thesis: Using Microearthquakes as Probes of Larger Earthquake Rupture
Advisor: Gregory C. Beroza

M.S. Geophysics — **Stanford University** — **2002**
Advisor: Gregory C. Beroza

B.S. Applied Geophysics (Cum Laude) — **University of California Los Angeles** — **2000**
Advisor: Paul M. Davis

EXPERIENCE

Mendenhall Postdoctoral Fellow — **USGS – Menlo Park** — **2008 - present**

Earthquake Location and Fault Mechanics

- Definitively showed that time- and slip-predictability do not reliably predict the behavior of natural repeating earthquakes or laboratory earthquakes
- Showed that there is some scaling (but not predictability) between slip and recurrence time in a slip-predictable sense that is driven by variable loading rates or coupling coefficients
- Developed a method based on the SVD for estimating relative moment of repeating earthquakes
- Identified repeating earthquakes on the San Andreas Fault in Parkfield, CA

Site Response

- Identified nonlinear site response for small magnitude $4 \leq M \leq 5$ earthquakes near Parkfield

Wave Propagation

- Identified shear waves propagating directly downward from explosive sources recorded at SAFOD
- Computing synthetic seismograms to replicate observations of explosive sources near Parkfield

Research Associate (Postdoc) — **University of Washington** — **2006-2007**

Episodic Tremor and Slip

- Identified 4 episodes of non-volcanic tremor in Cascadia that were triggered by distant earthquakes
  - Showed that the triggering of non-volcanic tremor is a simple, frictional process
  - Showed that nonvolcanic tremor can be triggered by both the Rayleigh waves and Love waves from distant earthquakes
  - Determined that timing and amplitude control whether non-volcanic tremor is triggered by teleseisms
- Identified 7 locations in California where non-volcanic tremor was triggered by the Denali Earthquake
- Showed that non-volcanic tremor in Cascadia is modulated by the solid-earth and ocean tides

Research Assistant — **Stanford University** — **2000-2006**

Earthquake Location and Fault Mechanics

- Developed a source-array beamforming technique to determine centroids of large earthquakes previously unlocated due to clipping of high gain waveforms
  - Used source-array beamforming to locate earthquakes on the Calaveras Fault
  - Showed that seismic streaks represent a boundary between creeping and locked portions of a fault block

- Wrote a neighbor selection algorithm based upon the Delaunay Tesselation and integrated it into double difference relocation program HYPODD

Nonlinear Strong Ground Motion/Nonlinear Site Response

- Identified short-duration velocity changes induced by large earthquakes
- Demonstrated that these velocity changes are a result of damage caused by strong shaking (nonlinear strong ground motion)
    - Used coseismic velocity reduction technique to identify nonlinearity in the strong ground motion of four earthquakes: Loma Prieta, Chittenden, Parkfield, and Tokachi-Oki
- Showed that rock strength strongly influences the susceptibility to nonlinear strong shaking, including damage induced by previous earthquakes (Loma Prieta and Chittenden)
- Provided the first field evidence that nonlinearity in strong ground motion is limited to the very near surface (Parkfield)
- Used spectral ratio technique to identify nonlinear strong ground motion in the Parkfield Earthquake
- Reconciled strong ground motion and coseismic velocity reduction observations of nonlinear strong ground motion in the Parkfield Earthquake

NSF-REU Summer Intern **University of Alaska, Fairbanks** **1999**

- Developed crustal S-Wave velocity model for Southern and Central Alaska

SCEC Summer Intern **University of California Los Angeles** **1998**

- Investigated azimuth dependent site amplifications of Northridge aftershocks in Sherman Oaks and Santa Monica

Research Assistant **University of California Los Angeles** **1997-2000**

- Analyzed spatial variation of site amplification for Northridge aftershocks recorded by stations throughout Los Angeles

AWARDS

Editor's Citation for Excellence in Refereeing **American Geophysical Union** **2011**

Stanford Graduate Fellowship **Stanford University** **2000-2003**
Awarded to top incoming graduate students

National Defense Science and Engineering Graduate (NDSEG) Fellowship Finalist **2000**
Awarded to top incoming graduate students in the sciences

University of California Regents Scholar **UCLA** **1996-2000**
Awarded to top incoming undergraduate students

Society of Exploration Geophysicists (SEG) Scholarship **SEG** **1996-2000**
Awarded to top undergraduate students in geophysics nationwide

John Handin Scholarship **UCLA Dept. Earth and Space Sciences** **1999**
Awarded yearly to top UCLA undergraduate in geophysics

PUBLICATIONS

1. **Rubinstein, J.L.** and W.L. Ellsworth, Repeating Earthquakes Are not Well Predicted by Standard Models of Earthquake Occurrence, *manuscript in preparation for Nature.*

2. Chen, K.H., T. Furumura, **J. L. Rubinstein**, and R-J. Rau, Modeling the healing of subsurface damage after the 1999 Chi-Chi earthquake, *manuscript in preparation for Geophysical Research Letters.*

3. **Rubinstein, J.L.**, W.L. Ellsworth, K.H. Chen, and N. Uchida, Fixed Recurrence and Slip Models Better Predict Earthquake Behavior than the Time- and Slip-Predictable Models 1: Repeating Earthquakes, *manuscript submitted to JGR.*

4. **Rubinstein, J.L.**, W.L. Ellsworth, N. Beeler, B.D. Kilgore, D. Lockner, and H. Savage, Fixed Recurrence and Slip Models Better Predict Earthquake Behavior than the Time- and Slip-Predictable Models 2: Laboratory Earthquakes, *manuscript submitted to JGR.*

5. Pollitz, F.F., **J.L. Rubinstein**, and W.L. Ellsworth, Source characterization of near-surface chemical explosions, *manuscript submitted to Geophysical Research Letters.*

6. Chen, K.H., T. Furumura, **J. L. Rubinstein**, and R-J. Rau, Observations of the healing of subsurface damage after the 1999 Chi-Chi earthquake, *manuscript submitted to Geophysical Research Letters.*

7. **Rubinstein, J.L.**, Nonlinear Site Response in Medium Magnitude Earthquakes Near Parkfield, CA (2011), *Bulletin of the Seismological Society of America*, v. 101, 275-286, doi: 10.1785/0120090396.

8. **Rubinstein, J.L.** and W.L. Ellsworth (2010), Precise Estimation of Repeating Earthquake Moment: Example from Parkfield, CA., *Bulletin of the Seismological Society of America,* v. 100, pp. 1952–1961, doi: 10.1785/012010.

9. Gomberg, J. and the Cascadia 2007 and Beyond Working Group (2010), Slow-slip phenomena in Cascadia from 2007 and beyond: A review, *GSA Bulletin*, v. 122, 963-978, doi: 10.1130/B30287

10. **Rubinstein, J.L.,** D.R. Shelly, and W.L. Ellsworth (2010), Non-Volcanic Tremor: A Window into the Roots of Fault Zone, in *New Frontiers in Integrated Solid Earth Sciences*, edited by S. Cloetingh and J. Negendank, pp. 287-314, Springer Netherlands.

11. **Rubinstein, J.L.**, J. Gomberg, J.E. Vidale, A.G. Wech, H. Kao, K.C. Creager, G. Rogers (2009), Seismic Wave Triggering of Non-Volcanic Tremor, ETS, and Earthquakes on Vancouver Island, *Journal of Geophysical Research*, v. 114, B00A01, doi: 10.1029/2008JB005875.

12. **Rubinstein, J.L.**, M. La Rocca, J.E. Vidale, K.C. Creager, A.G. Wech (2008), Tidal Modulation of Non-Volcanic Tremor, *Science*, v. 319, pp 186-189.

13. Gomberg, J., **J.L. Rubinstein,** Z. Peng, K.C. Creager, J.E. Vidale (2008), Widespread Triggering of Non-Volcanic Tremor in California, *Science,* v. 319, pp 173.

14. Peng, Z., J.E. Vidale, K.C. Creager, **J.L. Rubinstein**, J. Gomberg, and P. Bodin (2008), Strong tremor near Parkfield, CA excited by the 2002 Denali Earthquake, *Geophysical Research Letters,* vol. 35, L23305, doi: 10.1029/2008GL036080.

15. **Rubinstein, J.L.,** J.E. Vidale, J. Gomberg, P. Bodin, K.C. Creager, and S.D. Malone (2007). Non-volcanic tremor driven by large transient shear stresses, *Nature*, v. 448, pp 579-582.

16. **Rubinstein, J.L.**, N. Uchida, and G. Beroza (2007). Seismic Velocity Reductions Caused by the 2003 Tokachi-Oki Earthquake, *Journal of Geophysical Research*, v. 112, B05315, doi: 10.1029/2006JB004440.

17. **Rubinstein, J.L.** and G. Beroza (2007). Full Waveform Earthquake Location: Application to Seismic Streaks on the Calaveras Fault, California, *Journal of Geophysical Research,* v. 112, B05303, doi: 10.1029/2006B004463.

18. **Rubinstein, J.L.** and G. Beroza (2005). Depth constraints on nonlinear strong ground motion from the 2004 Parkfield earthquake, *Geophysical Research Letters*, v. 32, L14313, doi: 10.1029/2005GL023189.

19. **Rubinstein, J. L.** and G. Beroza (2004). Nonlinear strong ground motion in the M_L 5.4 Chittenden Earthquake: Evidence that preexisting damage increases susceptibility to further damage, *Geophysical Research Letters,* v. 31, L23614, doi: 10.1029/2004GL021357.

20. **Rubinstein, J. L.** and G. Beroza (2004). Evidence for widespread nonlinear strong ground motion in the M_w 6.9 Loma Prieta Earthquake, *Bulletin of the Seismological Society of America,* v. 94, pp. 1595–1608.

21. Hooper, A., P. Segall, K. Johnson, and **J. L. Rubinstein** (2002). Reconciling seismic and geodetic models of the 1989 Kilauea South Flank Earthquake, *Geophysical Research Letters*, v. 29, pp. 19-1 – 19-4, doi: 10.1029/2002GL016156.

22. Davis, P., **J. L. Rubinstein,** K. Liu, S. Gao, and L. Knopoff (2000). Northridge Earthquake damage caused by geologic focusing of seismic waves, *Science*, v. 289, pp. 1746-175.

INVITED PRESENTATIONS (SINCE 2010)

Stress Triggering of Non-Volcanic Tremor, **University of Vienna Institute of Meteorology and Geophysics**, June 2011.

Neither Natural Repeating Earthquakes nor Laboratory Earthquakes are Well Described by the Time- and Slip-Predictable Models, **Istituto Nazionale di Geofisica e Vulcanologia (INGV Rome)**, June 2011.

Stress Triggering of Non-Volcanic Tremor, **Universidad de Los Andes Geoscience Seminar**, May 2011.

Triggering of Earthquakes and Tremor by the 2011 Tohoku Earthquake**, USGS-Menlo Park EQPRO Megaproject Meeting**, March 2011.

Triggering of Earthquakes and Tremor by the 2011 Tohoku Earthquake**, USGS-Menlo Park Briefing on the March 2011 off-Tohoku Earthquake**, March 2011.

Stress Triggering of Non-Volcanic Tremor, **University of Lausanne Institute of Geophysics Seminar**, March 2011.

Stress Triggering of Non-Volcanic Tremor, **ETH-Zurich Swiss Seismological Service Seminar**, March 2011.

Neither Natural Repeating Earthquakes nor Laboratory Earthquakes are Well-Described by the Time- and Slip-Predictable Earthquake Behavior Models, **ETH-Zurich Statistical Seismology Group Seminar**, March 2011.

Stress Triggering of Non-Volcanic Tremor, **University of North Carolina Department of Geological Sciences Colloquium**, February 2011.

Neither Natural Repeating Earthquakes nor Laboratory Earthquakes are Well-Described by Standard Earthquake Behavior Models, **USGS Reston Mendenhall Colloquium**, November 2010.

Except in highly idealized cases, repeating earthquakes and laboratory earthquakes are neither time nor slip-predictable, **USGS Menlo Park Earthquake Seminar**, October 2010.

Stress Triggering of Non-Volcanic Tremor, **Lawrence Berkeley National Laboratory**, August 2010.

Near surface damage induced by three moderate California earthquakes, **Academica Sinica (Taiwan) -- Institute for Earth Sciences Seminar**, March 2010.

Stress Triggering of Non-Volcanic Tremor, **National Taiwan Normal University**, March 2010.

SELECTED CONFERENCE PRESENTATIONS

Rubinstein, J.L. *et al.,* Widespread triggering of earthquakes and tremor by the 2011 M9.0 off-Tohoku earthquake, SSA 2011.

Rubinstein, J.L., W.L. Ellsworth, K. Chen, N. Uchida, and N. Beeler, Testing time- and slip-predictability with repeating earthquakes in California, Japan, Taiwan, and the Laboratory, G-COE Symposium: Dynamic Earth and Heterogeneous Structure 2010, Tohoku University, Sendai, Japan, *INVITED*.

Rubinstein, J.L. and W.L. Ellsworth, Small Repeating Earthquakes are Time- and Slip-Predictable When Magnitudes are Improved*,* 6th International Workshop on Statistical Seismology 2009, *INVITED.*

Rubinstein, J. L., J.E. Vidale, J. Gomberg, K.C. Creager, P. Bodin, S.D. Malone, A.G. Wech, Non-volcanic Tremor and Earthquakes Driven by the Large Transient Shear Stresses of the 2002 Denali Earthquake, AGU Fall 2007.

Rubinstein, J. L., J.E. Vidale, J. Gomberg, K.C. Creager, A. Wech, P. Bodin, S.D. Malone, Triggering of tremor by the strong shaking from distant earthquakes, GSA Cordilleran Section 2007.

Rubinstein, J. L., J.E. Vidale, K. Creager, and S. Malone, Relocating nonvolcanic tremor and high frequency earthquakes in Cascadia, AGU Fall 2006.

Rubinstein, J. L. and G. Beroza, Full-Waveform earthquake location and the mechanics of streaks on the Calaveras Fault, AGU Fall 2005.

Rubinstein, J. L. and G. Beroza, Nonlinear strong ground motion as observed by seismic velocity reductions, 10th International Workshop on Nonlinear Elasticity in Materials, July 2005.

Rubinstein, J. L. and G Beroza, Nonlinear strong ground motion in the 2004 Parkfield Earthquake, AGU Fall 2004, *INVITED*.

Rubinstein, J. L., G. Beroza, G. Bokelmann, and D. Schaff, Near surface damage caused by the strong ground motion of the M6.9 Loma Prieta and M5.4 Chittenden Earthquakes, AGU Fall 2002.

Rubinstein, J. L., Analysis of azimuthal variation in amplitude factors in Sherman Oaks and Santa Monica during the Northridge Earthquake Aftershock Sequence, SCEC 1998.

TEACHING EXPERIENCE

"Earthquakes and Volcanoes" Teaching Assistant **Stanford University** **2004**

- Organized and taught lectures on intraplate earthquakes and seismic gaps
- Led review sessions and assisted students in office hours
- Wrote homework sets

Advisor of SCEC Summer Intern Kate Prudchenko **Stanford University** **2004**

- Provided instruction in seismology and the basis of the project
- Assisted in development of code to analyze Coda Q using repeating earthquakes

"Earthquake Seismology" Teaching Assistant **Stanford University** **2003**

- Organized and taught lecture on earthquake location and relocation
- Assisted students in office hours

FIELD EXPERIENCE

SCEC Sponsored Tri-Center Earthquake Hazards and Engineering Field Trip to Japan **2004**

- Visited universities and earthquake engineering facilities with earthquake engineering students to improve communication between the earthquake engineering and earthquake seismology communities

Field Assistant for BEAAR, LABPSE, and LARSE II Experiments **1997-2000**

- Participated in array design and siting of seismometers
- Obtained permissions for deployment of seismometers on private property
- Installed and removed broadband and short period seismometers

COMPUTER SKILLS

Languages:
Matlab
Fortran 77/90
C shell/Bash

Operating Systems
Unix/Linux
Windows/DOS
Macintosh

SERVICE

Guest Editor for a special issue of the *Bulletin of the Seismological Society of America* on the 2011 off-Tohoku Earthquake **2011-2013**

Convener of Late-Breaking Special Session on 2011 off-Tohoku Earthquake **SSA 2011**

Session Chair on Special Session on Creative Waveform Analysis **SSA 2011**

Convener of Special Session on Episodic Tremor and Slip **GSA 2009, Fall AGU 2007**

Manuscript and Proposal Reviewer for
Science, Journal of Geophysical Research; Bulletin of the Seismological Society of America; Geophysical Research Letters; Geophysical Journal International; Pure and Applied Geophysics; Geochemistry, Geophysics, and Geosystems (G^3); the National Science Foundation; the Swiss National Science Foundation; Los Alamos National Laboratory; Institute for Geophysics and Planetary Physics (IGPP)

PROFESSIONAL AFFILIATIONS

American Geophysical Union
Seismological Society of America

MISCELLANY

Proficient in Spanish